Earth Science Data Education through Cooking up Recipes

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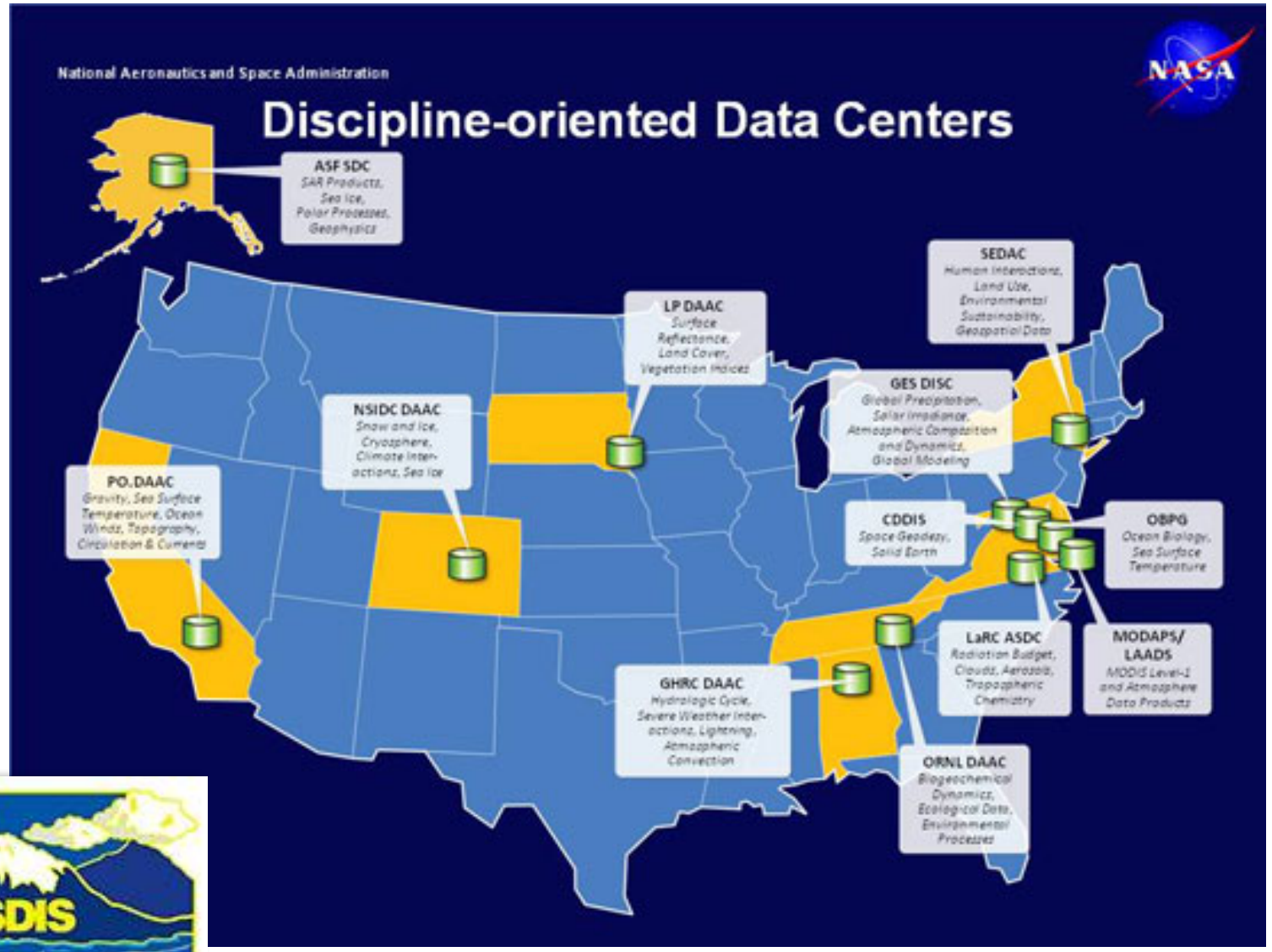
INFORMATION TECHNOLOGY AND SYSTEMS CENTER

THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

About GHRC

- There are *12 NASA Earth Science Data Centers*. One of these data centers
- Each center serves one or more scientific Earth science disciplines
- Global Hydrology Resource Center (*GHRC*), is located at the National Space Science and Technology Center in Huntsville, AL.
- GHRC is a collaborative effort between UAH and NASA



About GHRC

NASA Earth Science Data Systems Vision

Make NASA's free and open Earth science data interactive, interoperable and accessible for research and societal benefit today and tomorrow.

Mission Statement

- To provide a comprehensive and active archive of both data and knowledge augmentation services with a focus on **hazardous weather, its governing dynamical and physical processes,** and **associated applications.**
- Within this broad mandate, GHRC will focus on **lightning, tropical cyclones and storm-induced hazards** through integrated collections of satellite, airborne, and in-situ data sets.

http://ghrc.nsstc.nasa.gov/

GHRC Data User Profiles

User Types

- Undergraduate students
- Graduate students
- Atmospheric scientists
- Interdisciplinary scientists
- Decisions makers
- Data Innovators

A large range of user knowledge levels provides a challenge in data use, impeding scientific research and education

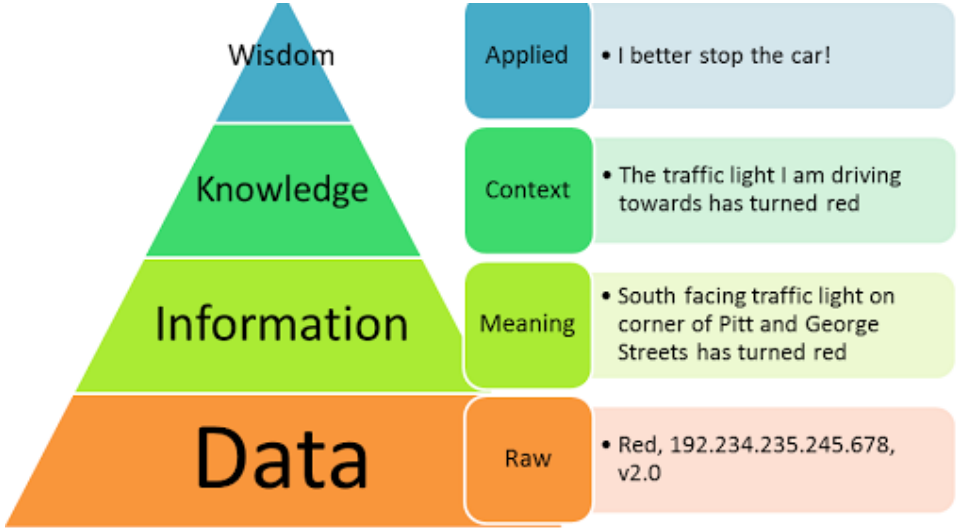
Data Recipes – What are they?

They have nothing to do with food, however like recipes they provide instructions on how to use data

- Easily and interpretable resources that enhance data usability
- Provide How-To instructions for various data.
- These may involve tools, science notebooks, software use instructions, data processing routines, web applications, and educational resources
- *Created to reduce the time it takes to learn how to use data*

Motivation

- Earth and atmospheric science is becoming increasing interdisciplinary as large quantities of data and information become available
- Data is available to a broad user base, each with their own needs and knowledge bases
  - A barrier exists for unfamiliar users, impeding data applications and scientific discovery
- Traditionally, acquiring the necessary knowledge to use scientific data has been limited to:
  - Coursework, experience, literature review
- Data recipes provide broad users with a linkage between data and wisdom

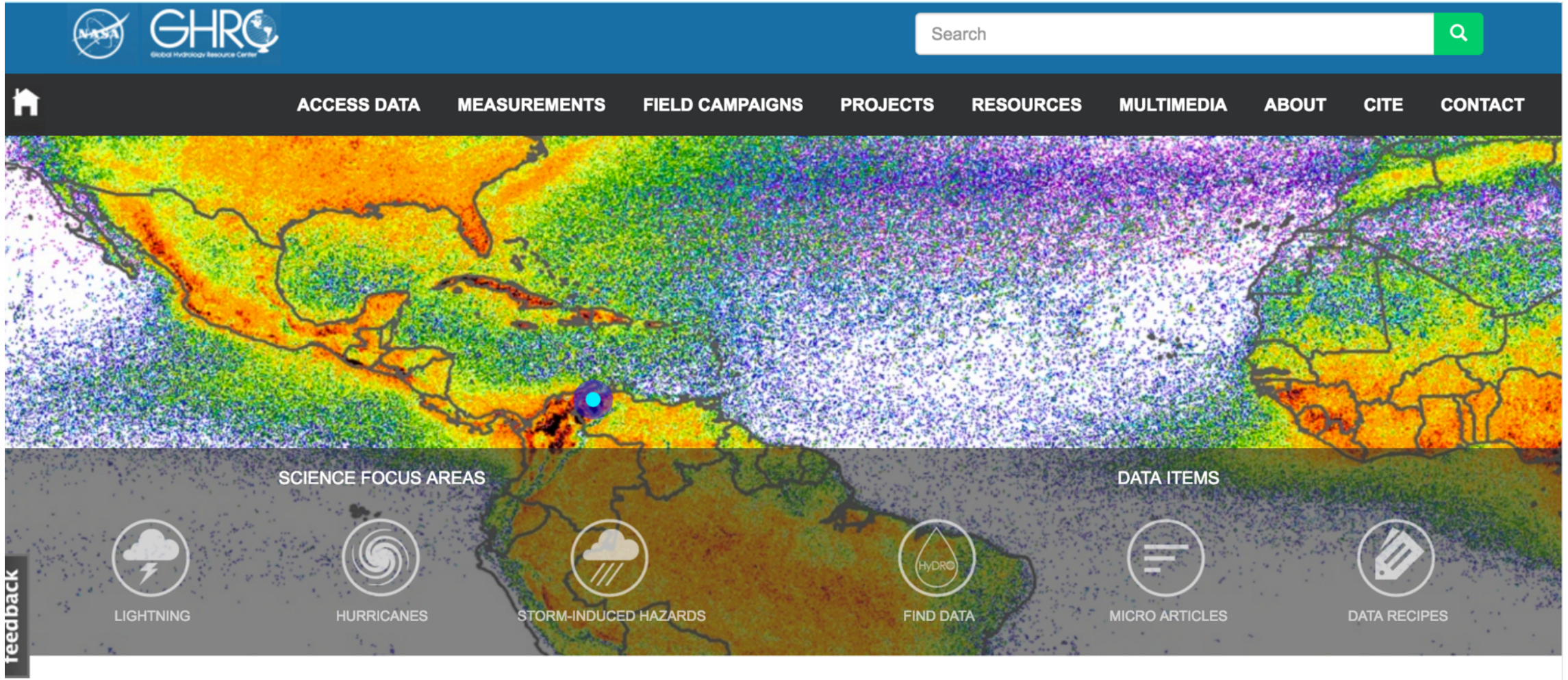


GHRC Data Recipes

- GHRC has begun compiling a series of data recipes that make our data and tools more usable to a broader user community
- The goal is to provide educational resources to instruct users on how to use GHRC data
- **What types do we offer?**
  - Using NetCDF data in ArcGIS
  - Python Notebooks and scripts
  - Dataset subsetting and plotting routines
  - Leveraging PyCMR
  - GHRC tool tutorials
- **Language** – Insure wording is not too technical and can be easily understood
- **Visuals** – Insure content is visually appealing and communicates information in an ingestible manner

Data Recipe Example

- Explore GHRC Data Recipes at: https://ghrc.nsstc.nasa.gov/home/data-recipes



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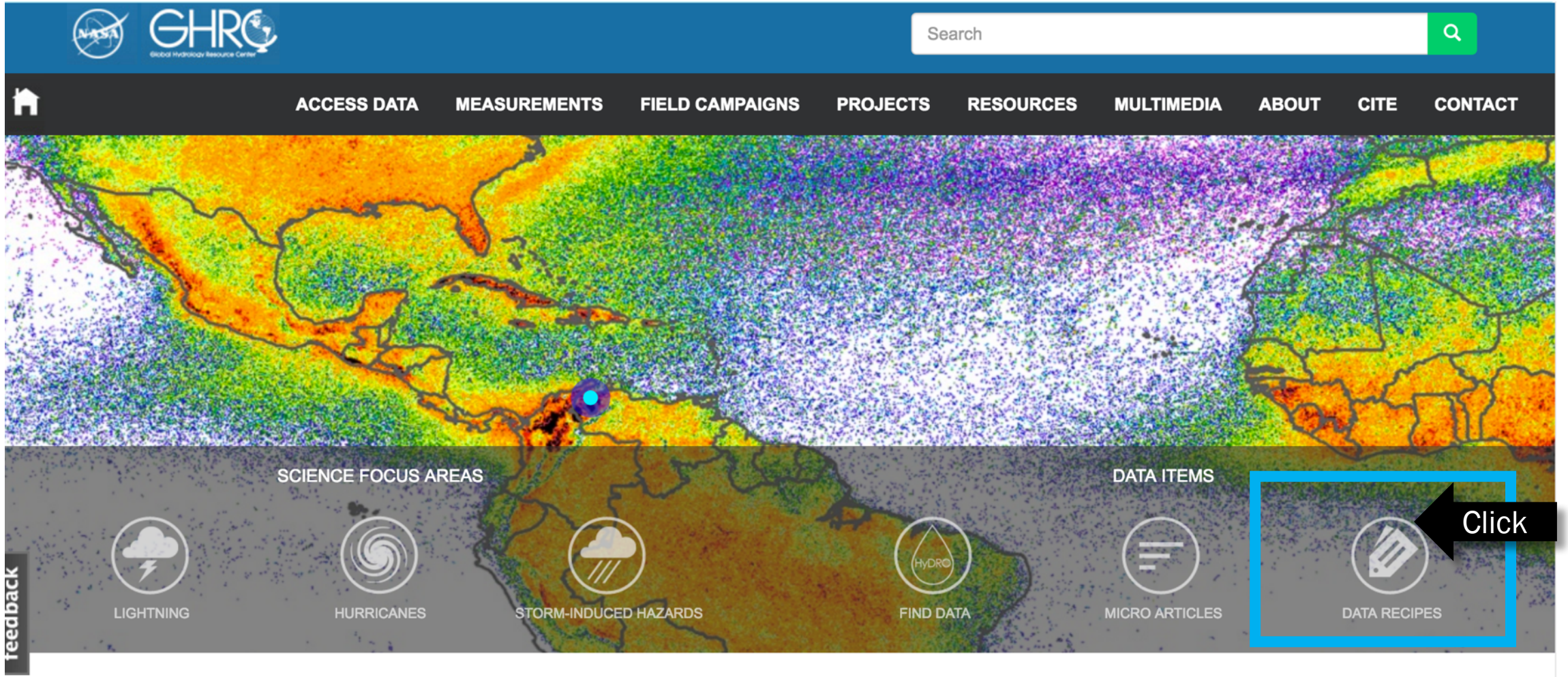
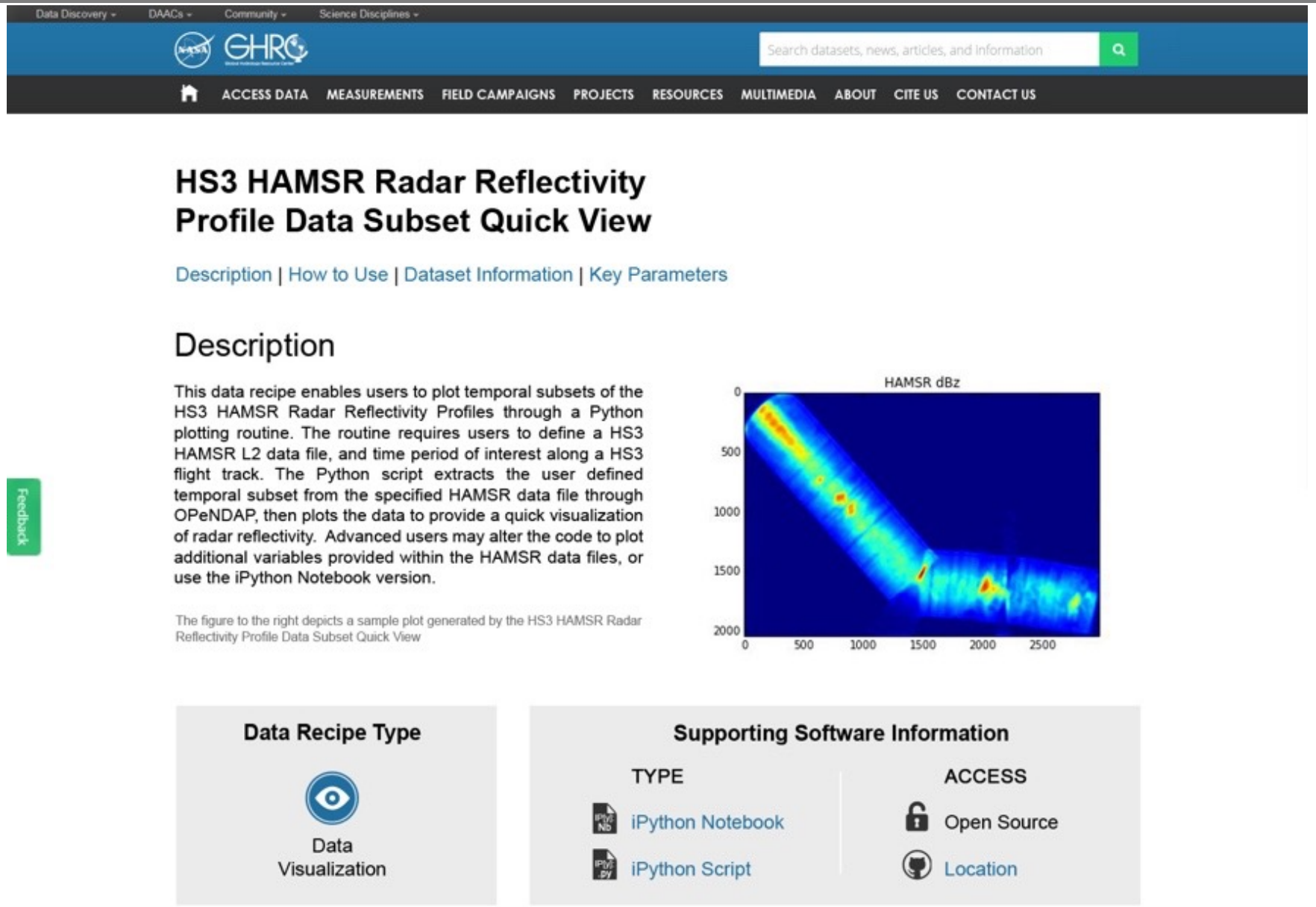
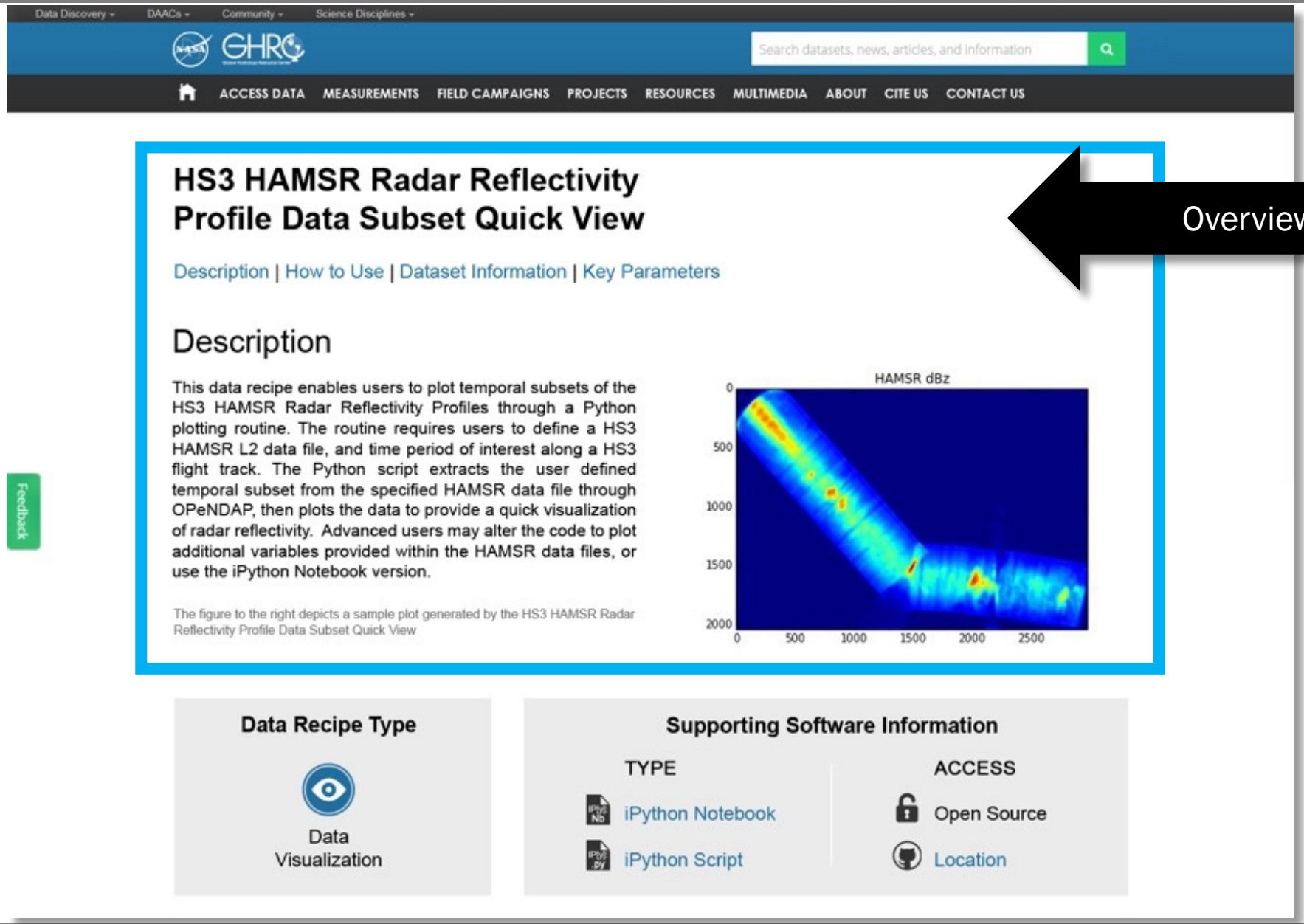


Data Recipe Example



Data Recipe Example



Overview

Data Recipe Example

Data Discovery | DAACs | Community | Science Disciplines

GHRC

Search datasets, news, articles, and information

ACCESS DATA | MEASUREMENTS | FIELD CAMPAIGNS | PROJECTS | RESOURCES | MULTIMEDIA | ABOUT | CITE US | CONTACT US

HS3 HAMSR Radar Reflectivity Profile Data Subset Quick View

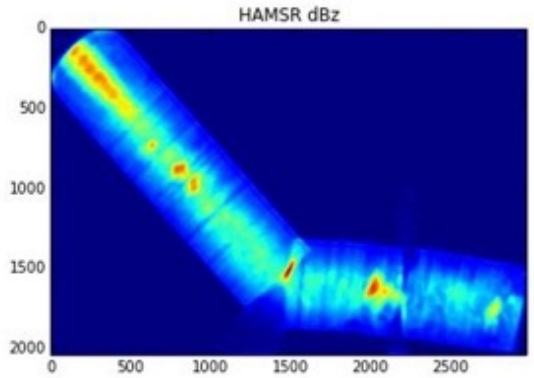
Description | How to Use | Dataset Information | Key Parameters

Key Descriptors

Description

This data recipe enables users to plot temporal subsets of the HS3 HAMSR Radar Reflectivity Profiles through a Python plotting routine. The routine requires users to define a HS3 HAMSR L2 data file, and time period of interest along a HS3 flight track. The Python script extracts the user defined temporal subset from the specified HAMSR data file through OPeNDAP, then plots the data to provide a quick visualization of radar reflectivity. Advanced users may alter the code to plot additional variables provided within the HAMSR data files, or use the iPython Notebook version.

The figure to the right depicts a sample plot generated by the HS3 HAMSR Radar Reflectivity Profile Data Subset Quick View



Feedback

Data Recipe Type

Data Visualization

Supporting Software Information

TYPE	ACCESS
iPython Notebook	Open Source
iPython Script	Location

Data Recipe Example

How to Use

This data recipe is available as a Python script and an iPython Notebook, which is an interactive Python environment for the web and shell. Instructions on how to use these recipes are as follows.

Please note that to run the Python script and iPython Notebook, the following Python modules are required:

matplotlib: http://matplotlib.org/
NumPy: http://www.numpy.org/
Pydap: http://www.pydap.org/
SciPy: https://www.scipy.org/

Recipe Instructions

STEP 1

Follow the location link on this page to access the GHRC DAAC data-recipe folder on GitHub. The HS3 HAMSR Radar Reflectivity Profile Data Subset Quick View has two separate files available for download:

iPython Notebook: HS3 HAMSR Data Recipe.ipynb
Python Script: HS3 HAMSR Data Recipe.py

You can preview each by clicking the file name. To download, select the green "Clone or download" button located on the right side of the webpage to download both scripts as a zipped file or open to your desktop.

STEP 2

The Python script provides a series of editable fields that can be used to subset and plot desired parameters and locations recorded within each HS3 HAMSR data file. This data recipe focuses on the radar reflectivity (ham_dBz) parameter.

The GHRC OPeNDAP link is used to pull in and plot subsets of data files. To change the default data file, simply substitute your desired file name within the datafile variable highlighted in the figure below.

Open data stream using OPeNDAP link to file and look for data fields

```
In [2]: datafile = open_url('https://hs3.nsstc.nasa.gov/opendap/hyrax/hs3/HAMSR/data/2013/HAMSR_L2_20130903T034600_20130904T020933_v01.nc')
print datafile.keys()
```

```
['time', 'lat', 'lon', 'altitude', 'TB', 'inc', 'AClat', 'AClon', 'ACroll', 'ACpitch', 'ACheading',
 'PWV', 'CLW', 'sea_ice_flag', 'anc_sfc_ht', 'anc_Psfc', 'land_flag', 'anc_ws', 'ham_airT', 'ham_airQ', 'ham_airL', 'ham_airRH', 'ham_airPT', 'ham_airEPT', 'ham_LCL', 'ham_LFC', 'ham_prof_PWV', 'ham_prof_CLW', 'ham_sfc_airT', 'ham_sfc_airQ', 'ham_sfc_airRH', 'ham_FltLvl_airT', 'ham_FltLvl_airQ', 'ham_FltLvl_airRH', 'ham_ret_qual_flag', 'ham_pres_levels', 'ham_airHt', 'ham_dBz', 'ham_dBz_heights']
```

Data Recipe Example

Dataset Information

Dataset Name	Hurricane and Severe Storm Sentinel (HS3) Global Hawk High Altitude MIC Sounding Radiometer (HAMSR) L2
Platform	Global Hawk UAV
Instrument	High Altitude MMIC Sounding Radiometer (HAMSR)
Science Parameter	Radar Reflectivity
Format	NetCDF-CF
Data Information	

Data and Parameters

Key Parameters

VARIABLE	DESCRIPTION	DIMENSION	UNITS	SCALE FACTOR
time	Time	n/a	seconds	1.0
lat	Latitude	along track	degrees	0.001
lon	Longitude	along track	degrees	0.001
ham_dBz	HAMSR X-band reflectivity derived from HAMSR TBs at 33 levels (dBz)	along track	dBz	0.01

Upcoming Data Recipes

- Hurricane and Severe Storm Sentinel (HS3) Cloud Precipitation Lidar Quick View
  - Python plotting routine
- How to find GHRC data
- How to use gridded NetCDF data in ArcGIS
- How to use time-series NetCDF data in ArcGIS
- How to use Lightning Imaging Sensor (LIS) data
  - ISS LIS Launch 2017
  - Lightning Data Center
  - Collaboration with lightning scientists and educators on the GHRC User Working Group

Conclusions

- Data recipes provide GHRC data users with resources for learning how to use data
- These resources are crafted to be understandable to a wide user base
- They provide and curate information that traditionally requires time consuming and manual effort for unfamiliar users to identify
- GHRC data recipes place an emphasis on the visual presentation of content in order to communicate and educate users better

Thank you

Questions?

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